DOCUMENT RESUME

ED 338 363 PS 019 914

AUTHOR Kestenbaum, Roberta
TITLE The Processing of Emotional Expressions as Discrete and Global Categories.
PUB DATE Apr 91
NOTE 14p.; Paper presented at the Biennial Meeting of the Society for Research in Child Development (Seattle, WA, April 18-20, 1991).
PUB TYPE Reports - Research/Technical (143) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Adults; Anger; *Children; *Facial Expressions; Fear; *Holistic Evaluation; *Social Cognition; Vertical Organization
IDENTIFIERS Discrete Variables; Emotions; Happiness; *Negative Affect; *Positive Affect; Surprise

ABSTRACT

This study explored the use of analytic and holistic modes of processing in the recognition of emotional expressions as discrete and global categories. Five- and seven-year-olds and adults were presented with a series of slides that showed different parts of faces depicting either happiness, surprise, fear, or anger. Slides ranged from single features to full faces. In the discrete categories condition, individuals were asked to press a button for each of the target emotions. In the global categories condition, the target terms were "feels good" and "feels bad." Results indicated that the mouth was the dominant feature for happiness and the eyes were the dominant feature for fear and anger. There were more correct responses to the nondominant feature for each emotion in the global condition than in the discrete condition. Individual features were more useful in identifying global categories than discrete categories, and younger children relied more on single features than combinations of features. For younger children, surprise had positive associations, but the expression of surprise was perceived as an expression of a negative emotion. Results suggested that the ability to recognize emotional expressions follows different courses of development for different emotions. A list of 13 references is included. (BC)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

The Processing of Emotional Expressions as Discrete and Global Categories

Roberta Kestenbaum

University of Michigan

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
X This document has been reproduced as received from the person or organization originating it.
☐ Minor changes have been made to improve reproduction quality.
• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

ED338363

Abstract

The use of analytic and holistic modes of processing in the recognition of emotional expressions as discrete and global categories was explored. Five- and seven-year-old children and adults were presented with series of slides of happiness, surprise, fear, and anger with different parts of the faces exposed, ranging from single features (e.g., the mouth) to full faces. In Condition 1 (Discrete Categories), individuals were asked to press a button for each of the target emotions: happiness, surprise, fear and anger. In Condition 2 (Global Categories), the target terms were "feels good" and "feels bad". In general, individual features were better for identifying global categories than discrete categories, and younger children tended to rely more on single features than combinations of features. In addition, for younger children, the concept of surprise had positive associations, but the perception of the surprise expression was as a negative emotion. The results are discussed in terms of changes over development in processing emotional expressions, and whether the classification of emotional expressions fits a classic hierarchical model of categorization. It is suggested that the ability to recognize and process emotional expressions appears to follow different courses of development for different emotions.

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY
Roberta Kestenbaum
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

Presented at the meeting of the Society for Research in Child Development, April, 1991, Seattle, Washington

PS 019174

BEST COPY AVAILABLE

In the study of concept acquisition, it has been suggested that the preferred mode of processing changes over development from a bias towards holistic processing to a bias towards analytic processing (Alexander & Enns, 1988; Kemler, 1983; Smith, 1981). However, others have argued that children may not always process on a holistic basis. For example, Ward, Vela, Peary, Lewis, Bauer, and Klint (1989) found that preschoolers were as likely as older children and adults to classify artificial, novel stimuli based on attributes rather than overall similarity. However, preschoolers tended to rely on only one feature in making categorical decisions, while the older children and adults took into account more features. One of the goals of the present study was to investigate this issue within a specific stimulus domain: facial expressions of emotion. The processing of facial expressions may be different for each discrete expression since some expressions have been shown to be easier to recognize (e.g., happiness), and some may be more readily recognized by single features, such as the smile for happiness. In addition, besides being classified as discrete categories like "happiness" and "anger", emotional expressions can be identified more broadly in terms of hedonic tone or positivity/negativity, which may require different means of processing. However, which discrete emotional expressions are considered to be positive and negative has not been directly explored, even when broader categories have been considered. Instead, inferences about global categories have been made from the types of confusions that have occured (e.g., Bullock & Russell, 1985).

The relation between discrete categories and global categories such as positivity/negativity can be described by the classic "hierarchical model", in which some categories are at the basic level, and others are at the superordinate level. Discrete categories such as anger and happiness provide the best fit to what Rosch, Mervis, Gray, Johnson, and Boyes-Braem (1976) describe as basic level categories (Fehr & Russell, 1984). Presumably, the categories maximize within-category similarity relative to between-category similarity. Tversky and Hemenway (1984) have suggested that the advantage of basic level categories is that they can be discriminated from one another on the basis of parts rather than functional aspects. Thus, it would be expected that basic level categories such as happiness or anger would be discriminated on the basis of parts or features, and they would be learned before superordinate categories like positive emotions and negative emotions. Greater accuracy and quicker responding to discrete categories would also be expected.

However, researchers looking specifically at the recognition of emotional expressions have suggested just the opposite: attending to just one isolated feature may not be enough to differentiate discrete emotions. Ekman (1979) has suggested that isolated features alone may

be sufficient for identifying whether an emotion is positive or negative, but not for identifying discrete emotions. In addition, Russell and Bullock (1986a) suggested that emotional expressions are initially identified in terms of abstract dimensions such as hedonic tone, and then secondarily, in terms of more precise categories. Thus, individuals should respond more rapidly and with greater accuracy when identifying an emotion as positive or negative than as a discrete category. In studies with young children, Bullock and Russell (1985, 1986; Russell & Bullock, 1986b) found that younger children's emotion categories were so broad as to include only positive and negative emotions. Thus, they should recognize global categories more readily than discrete categories.

The present study explored differences in the recognition of emotional expressions when they were treated as discrete categories and as more global categories. In conjunction with this, the use of analytic vs. holistic processing in the recognition of emotional expressions was also explored. A third goal of the study was to determine whether "surprise" is considered to be positive or negative. Some investigators have suggested that surprise may have more positive connotations for younger children (Bullock & Russell, 1985).

Five- and seven-year-old children, and adults, were presented with several series of slides of different individuals posing four discrete emotional expressions (happiness, surprise, fear, and anger). In each series, exemplars of the four emotions were presented with different parts of the faces exposed. To explore featural analysis, expressions were presented with only the mouth showing, only the eyes showing, or only the mouth and eyes displayed. To study holistic processing, both the full expression, and the full expression without the nose were shown. Since emotions cannot be identified by the nose by itself, removing the nose should not disrupt featural analysis. In contrast, since blocking the nose does change the overall configuration or Gestalt, holistic processing should be somewhat disrupted.

In the first condition (Discrete Categories), subjects were asked to push a button for the target emotions of happiness, surprise, fear and anger, for each of four series of slides. In the second condition (Global Categories), subjects were given the target terms "those who feel good" and "those who feel bad" for positivity and negativity, respectively. A third condition, for adults only, used the terms "positive emotions" and "negative emotions". This condition was included in order to compare it with the adults' responses in Condition 2 to see if "positive" and "feels good", and "negative" and "feels bad" were equivalent terms. There were no differences between the two conditions; thus, this last condition is not discussed further.

Method

Subjects

Forty children aged 58 to 68 months (M = 63), 40 children aged 82 to 90 months (M = 86), and 60 adults (range = 18 to 62 years) participated in the study. The majority of the subjects were from Caucasian, middle-class families. Equal numbers of males and females were included in each group. Twenty subjects from each age group were randomly assigned to Condition 1 (Discrete Categories), and twenty subjects from each age group were assigned to Condition 2 (Global Categories). In addition, the remaining 20 adults participated in Condition 3 (Positivity/Negativity).

Stimuli

All test stimuli were black and white slides of individual faces of six adult men and seven adult women chosen from Ekman's (1976) Pictures of Facial Affect. Five different stimulus types were created for each of four emotions: happiness, surprise, fear, and anger. The five stimulus types were as follows: (1) Eyes Only, (2) Mouth Only, (3) Combination of Mouth and Eyes, (4) Nose Missing, and (5) Full Face. (see Figure 1)

Design and Procedure

Four series of 60 slides each were created that consisted of three exemplars of each of five stimulus types (Eyes Only, Mouth Only, Combination of Mouth and Eyes, Nose Missing, and Full Face) for each of four emotions (Happiness, Surprise, Fear, and Anger). The series of slides were always presented in the same order, but the naming of the target emotions was counterbalanced across subjects.

After an initial training session with slides of animals, the subjects were given a target for which they were to press a button held in their dominant hand. For Condition 1 (Discrete Categories), subjects were presented with all four series, and the target emotions were happiness, surprise, fear, and anger. For Condition 2 (Global Categories), subjects were presented only with the first two series, and the targets were "those who feel good" and "those who feel bad". The order in which the targets were named was alternated between subjects. Each slide was displayed for 1.5 sec with 1 sec intervening between slides. Before and after each series subjects were asked to repeat which emotion they were going to press (or just had pressed) the button for.

Data preparation

Scores were collapsed across models for each stimulus type for each emotion so that each score consisted of the responses to three examples. Scores were of two types: "hits" - responses when the stimulus emotion and the target term matched, and "false alarms" - responses when the stimulus and target did not match, for both frequency of button pushes

and reaction times. The results for frequency scores and reaction times were analyzed separately.

Results

Frequency Scores

Discrete categories vs. global categories. Two separate analyses were performed comparing the "hits" in Condition 1 to the "hits" in Condition 2. In the first analysis, hits for the stimuli of happiness, fear, and anger were included. The stimuli for surprise were excluded since a clear "hit" for surprise in Condition 2 could not be determined due to the uncertainty of the valence. Thus, in a second analysis, "surprise" from Condition 1 was compared to surprise when the target was positive and surprise when the target was negative from Condition 2. Condition, Age, Stimulus Emotion and Stimulus Type were the factors included in the ANOVAs.

In general, for happiness, the mouth was the dominant feature, and for fear and anger, the eyes were the dominant feature. There were also more correct responses to the non-dominant features for each emotion in the Global Condition than in the Discrete Condition. In addition, for happiness, there was very little difference in performance for the different stimulus types, except that children had more difficulty with the eyes only. For fear and anger, all age groups performed the worst with the non- dominant feature (i.e., the mouth), but for the younger age groups, a combination of the dominant feature with the non-dominant feature did not improve performance over having just the dominant feature present. For the adults (and 7-year-olds for anger), adding the extra feature did improve performance. (See Figure 2.)

When "surprise" was the target, the eyes were dominant, but when the target was "feels good" or "feels bad", neither feature was dominant. There were no differences in performance with the different stimulus types when "surprise" was the target, except that the adults and 7-year-olds performed less accurately with the mouth. For surprise-negative, the combination of mouth and eyes did not produce any more responses than did the mouth or eyes individually, although the full faces did produce more correct responses from the adults. Responses to surprise- positive were the most unusual: there were fewer responses to the full face than to the mouth only for five-year-olds.

In addition, an analysis of the types of confusions that occurred suggested that the younger children were more likely to include the happiness stimuli when the target was surprise than were the older children and adults. However, in the Global condition, the surprise stimuli were more often considered to be negative than positive by all age groups.

Reaction Times

Because reaction times to hits are dependent on hits actually being produced, some subjects did not have data for every cell. In other words, if a subject did not push the button for any of the three exemplars for a particular stimulus type (e.g., Eyes Only for anger), a reaction time score could not exist and that cell would need to be filled by an estimate. For the following analyses, estimates were computed by the method of maximum likelihood. Since using imputed values reduces the number of variables free to vary, Mean Squares were corrected after reducing the degrees of freedom by the number of missing values.

Differences in reaction times for Condition 1 vs. Condition 2. Only the reaction times for hits for happiness, fear and anger were included in this analysis because too many data points were missing for surprise (38 %). A 2 (Condition) x 3 (Age) x 3 (Stimulus Emotion) x 5 (Stimulus Type) Analysis of Variance with repeated measures on the last two factors was performed on the reaction times to hits for happiness, fear, and anger. Seven- year-olds and adults responded more quickly to happiness than to fear. For five-year-olds, there were no differences. For happiness, responses were slower to the eyes only stimuli than to the combination of features or the full faces. For anger, responses were slower to the mouth than to the full faces. There were no differences between stimulus types for fear.

Discussion

In general, it was easier to recognize global categories than discrete categories from non-dominant features, and the distinction between non-dominant and dominant was not as relevant for global categories. Overall, features were better for recognizing global categories. This supports Ekman's (1979) suggestion that distinct emotional expressions may not always be easily identified from a single feature, since expressions may share features, but that positivity/negativity could. These results further indicate that this may only be the case when the feature is not dominant. Thus, discrete emotion categories could be recognized from a single feature if the feature were dominant for that particular expression. If only a non-dominant feature was presented, then positivity/negativity could more readily be identified than could a discrete expression. These results are in conflict with what would be predicted from a hierarchical approach, which suggests that basic level categories are identified better from parts than are superordinate categories (Tversky & Hemenway, 1984). According to Rosch et al. (1976), for basic-level categories, the within-similarity is maximized, and the between-similarity is minimized. However, for emotional expressions, it may be that configurations of features characterize basic level categories, while within superordinate categories, some individual features are shared. As Ekman (1979) has illustrated, the furrowed brow may not be enough to recognize either sadness or anger, unless

it is in combination with another feature, but it would be enough to recognize negative hedonic tone. In addition, within categories, some features may not be shared. For example, a smile can either expose teeth or not. Thus, basic level emotion categories do not maximize within- category similarity and minimize between-category similarity. Emotional expressions, then, do not fit in to the classic hierarchical model.

Although for other types of stimuli (e.g., furniture or animals), different exemplars generally are considered to elicit the same kind of processing, for emotional expressions, it is necessary to consider each one individually. The type of processing for identifying emotional expressions, and changes over development, appear to be related to the ease of recognition for the individual emotions. A developmental progression from using single features to integrating features was found for surprise, fear, and anger. How a particular expression was processed was related both to age and to the ease of recognizing the emotion. For example, younger children's performance improved at a greater rate when combinations of features, rather than just single features, were presented for anger than it did for fear and surprise, which are more difficult in general to recognize. Thus, for emotions that are generally easier to recognize from the full face, children used a more integrated analytic mode of processing at a younger age. This is similar to Ward et al.'s (1989) findings with other types of object stimuli that young children discriminated on the basis of single features, whereas older individuals used a more integrated analytic mode, based on combinations of features. Happiness was an anomoly, possibly because of the salience of the smile: processing was featurally based on the mouth, and there were no indications that adding another feature improved performance.

The results do not support the hypothesis that there is a shift over development from holistic to analytic modes of processing. Instead, there appears to be a change from greater reliance on single features to greater reliance on multiple features. This is a particularly important development for the recognition of discrete emotional expressions, since some appear to be determined by configurations of features.

Finally, younger children's concepts of surprise seem to be more closely tied in with their concepts of happiness, yet they tended to perceive the surprise stimuli as negative. This suggests that their concept of "surprise" (as elicited by the target word "surprise") differs from their perception of the surprise expression, which is often confused with fear. Thus, the ability to recognize an emotional expression, and the understanding of a particular emotion concept do not necessarily develop concurrently.

References

Alexander, T.M. & Enns, J.T. (1988). Age changes in the boundaries of fuzzy categories. Child Development, 59, 1372- 1386.

Bullock, M. & Russell, J.A. (1985). Further evidence on preschoolers' interpretation of facial expressions. International Journal of Behavioral Development, 8, 15-38.

Bullock, M. & Russell, J.A. (1986). Concepts of emotion in developmental psychology. In C.E. Izard & P.B. Read (Eds.), Measuring emotions in infants and children, Vol. 2. (pp. 203- 237). N.Y.: Cambridge University Press.

Ekman, P. (1976). Pictures of facial affect. Palo Alto, CA: Consulting Psychologists Press.

Ekman, P. (1979). About brows: emotional and conversational signals. In M. von Cranach, K. Foppa, W. Lepenies, & D. Ploog (Eds.), Human Ethology. (pp. 169-202). London: Cambridge University Press.

Fehr, B. & Russell, J.A. (1984). Concept of emotion viewed from a prototype perspective. Journal of Experimental Psychology: General, 113, 464-486.

Kemler, D.G. (1983). Holistic and analytic modes in perceptual and cognitive development. In T.J. Tighe & B.E. Shepp (Eds), Perception, cognition, and development. (pp. 77-102). Hillsdale, N.J.: Erlbaum.

Rosch, E., Mervis, C.B., Gray, W.D., Johnson, D.M., & Boyes-Braem, P. (1976). Basic objects in natural categories. Cognitive Psychology, 8, 382-439.

Russell, J.A. & Bullock, M. (1986a). On the dimensions preschoolers use to interpret facial expressions of emotion. Developmental Psychology, 22, 97-102.

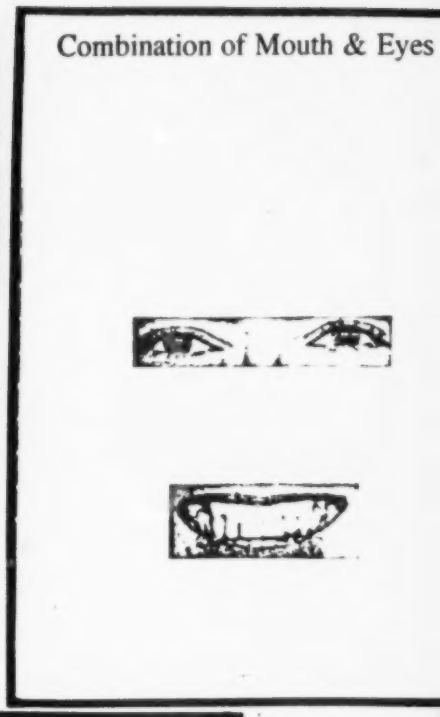
Russell, J.A. & Bullock, M. (1986b). Fuzzy concepts and the erception of emotion in facial expressions. Social Cognition, 4, 309-341.

Smith, L.B. (1981). Importance of the overall similarity of objects for adults' and children's classifications. Journal of Experimental Psychology: Human Perception and Performance, 7, 811-824.

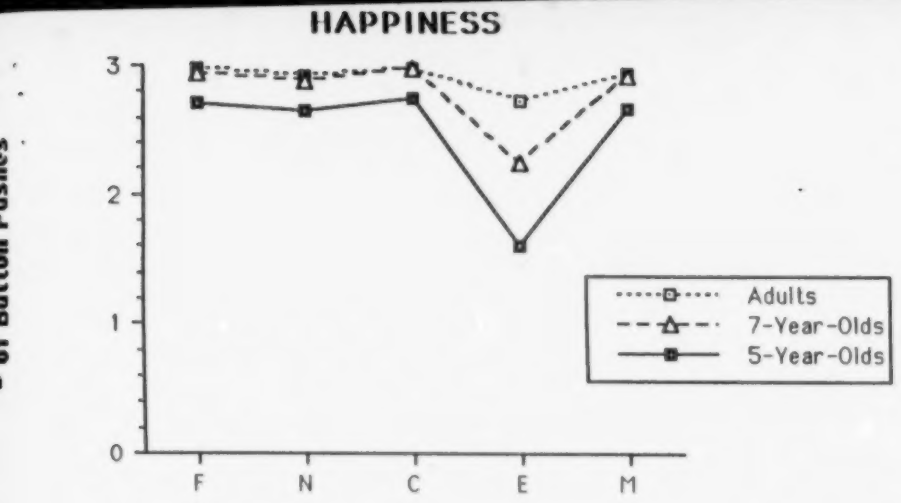
Tversky, B. & Hemenway, K. (1984). Objects, parts, and categories. Journal of Experimental Psychology: General, 113, 169-197.

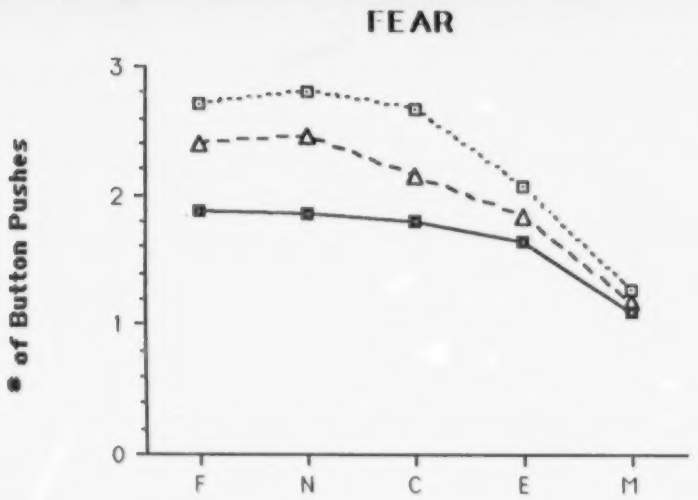
Ward, T.B., Vela, E., Peary, M.L., Lewis, S.N., Bauer, N.K., & Klint, K.A. (1989). What makes a vibble a vibble? A developmental study of category generalization. Child Development, 60, 214-224.

FIGURE 1



BEST COPY AVAILABLE





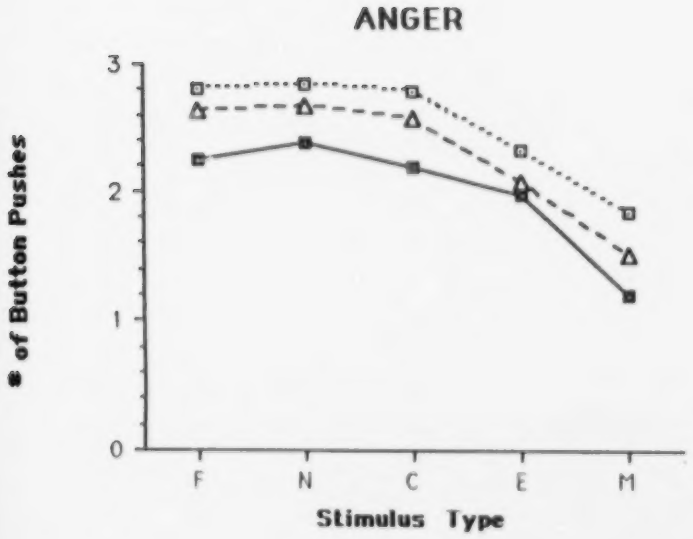
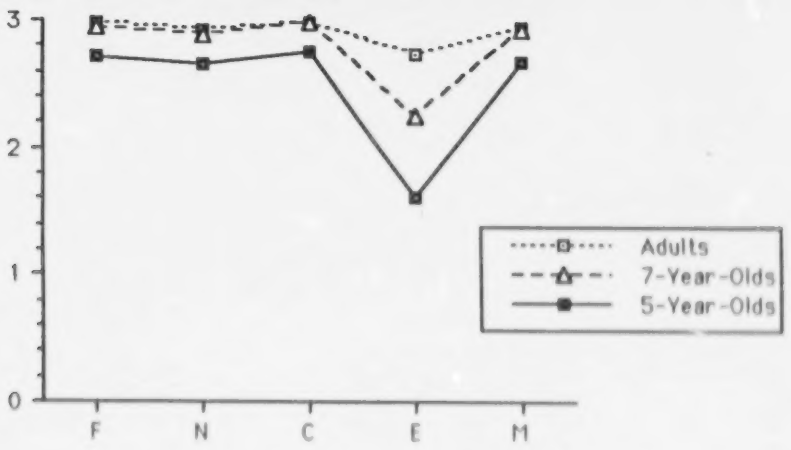
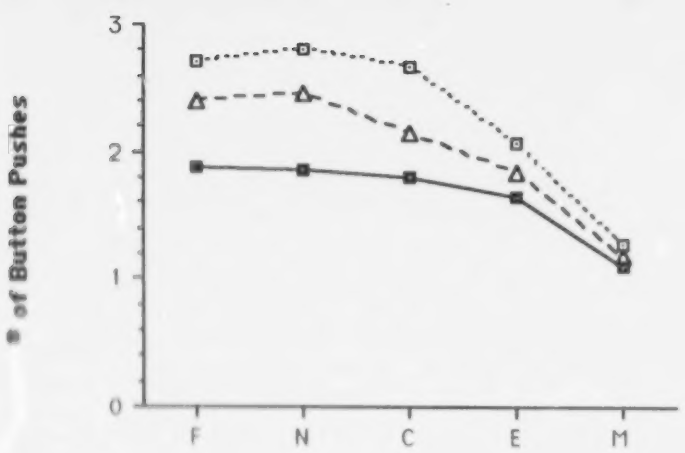


Figure 2. Adults', 7-year-olds', and 5-year-olds' frequency scores (out of a possible 3) for each stimulus type for each hit for happiness, fear and anger, for Condition 1 and Condition 2 combined. It can be seen that for happiness, the mouth was the dominant feature, and for fear and anger, the eyes were the dominant feature. For happiness, there was little difference between the stimulus types, except that children had more difficulty with the eyes only. For fear and anger, for the children, a combination of the two features did not improve performance over having just the dominant feature present. For the adults (and 7-year-olds for anger), adding the extra feature did improve performance.

KEY: F = Full Face, N = Nose Missing, C = Combination of Mouth & Eyes, E = Eyes Only, M = Mouth Only





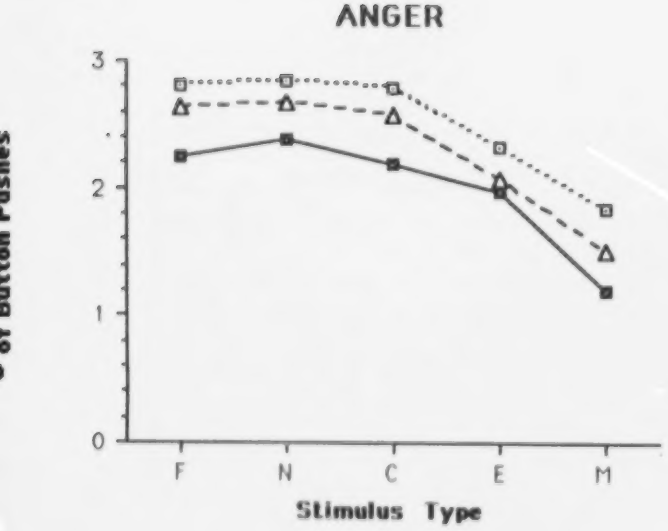


Figure 2. Adults', 7-year-olds', and 5-year-olds' frequency scores (out of a possible 3) for each stimulus type for each hit for happiness, fear and anger, for Condition 1 and Condition 2 combined. It can be seen that for happiness, the mouth was the dominant feature, and for fear and anger, the eyes were the dominant feature. For happiness, there was little difference between the stimulus types, except that children had more difficulty with the eyes only. For fear and anger, for the children, a combination of the two features did not improve performance over having just the dominant feature present. For the adults (and 7-year-olds for anger), adding the extra feature did improve performance.

KEY: F = Full Face, N = Nose Missing, C = Combination of Mouth & Eyes, E = Eyes Only, M = Mouth Only